FINAL WORK PLAN
Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

APPENDIX E

Munitions Constituents Sampling & Analysis Plan

(Field Sampling Plan • Quality Assurance Project Plan)

Prepared for
United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville

Contract Number: W912DY-05-D-0007
Task Order Number: 0001
Project Number: I02PR006802

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Part I

Field Sampling Plan

FINAL

Field Sampling Plan
Non-Time-Critical Removal Action at the Municipality of Culebra, PR

US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007, TO #0001

Independent Technical Review Certification

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Abbreviations & Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ASR	Archives Search Report
CEHNC	United States Army Engineering and Support Center, Huntsville
DoD	Department of Defense
ECB	Environmental Chemistry Branch
EE/CA	Engineering Evaluation / Cost Analysis
EEG	Ellis Environmental Group, LC
ER	Engineer Regulation
FSP	Field Sampling Plan
FWS	Fish and Wildlife Service
GPS	global positioning system
HPLC	high-performance liquid chromatography
ID	identification
IDW	investigation-derived waste
LIMS	Laboratory Information Management System
MEC	munitions and explosives of concern
MS	matrix spike
MSD	matrix spike duplicate
NAD83	North American Datum of 1983
NG	nitroglycerin
OOU	ordnance operating unit
PE	professional engineer
PETN	pentaerythritol tetranitrate
PG	professional geologist
ppb	parts per billion
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SOW	Scope of Work
STL	Severn Trent Laboratories
TAL	Target Analyte List
USACE	United States Army Corps of Engineers
UTM	Universal Transverse Mercator
UXO	unexploded ordnance

1.0 Project Background

Ellis Environmental Group, LC (EEG), under Contract W912DY-05-D-0007 to the United States Army Engineering and Support Center, Huntsville (CEHNC), has been tasked with the collection and the analysis of pre-detonation and post-detonation soil samples for Target Analyte List (TAL) metals plus strontium by Methods 6010B/7471A, explosives by Method 8330, perchlorate by Method 314.0, plus pentaerythritol tetranitrate (PETN) and nitroglycerin (NG) by Method 8332M, at the former naval target range on Culebra Island and its surrounding cays. These sites include the Northwest Peninsula and Flamenco Beach (bombing and naval bombardment range), Cerro Balcon (mortar range), Isla Culebrita (strafing range and torpedo range), and Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza (all aerial bombardment sites).

1.1 Site History

Refer to Subchapter 1.1 of the Work Plan.

1.2 Site-Specific Definition of Problems

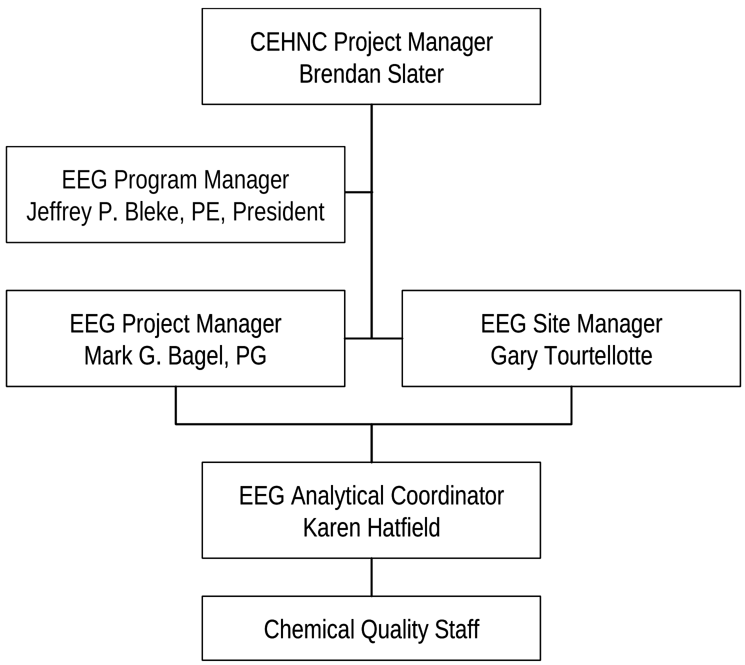
The Scope of Work (SOW) is to conduct a munitions and explosives of concern (MEC) removal action. The sampling will be conducted to determine if the demolition of MEC adversely impacts the soil quality in the site area.

2.0 Project Organization

2.1 Overall Project Organization and Responsibilities

2.1.01 EEG has established a project team of qualified personnel to provide oversight and quality control (QC) for this project. **Figure 2-1** shows the project organization that will control implementation of this Field Sampling Plan (FSP), and the following text describes responsibilities and chains of command.

Figure 2-1. Sampling Team Organization Chart



2.1.02 Brendan Slater is the CEHNC project manager. He is the technical representative of the CEHNC contracting officer and will be the primary point of contact during all phases of the project. He will review all contract deliverables, will be the primary point of contact for all project scope changes, and will manage the CEHNC technical team that is responsible for the review of all field change requests during the sampling effort.

2.1.03 Jeffrey P. Bleke, professional engineer (PE), is the EEG program manager. He is responsible for ensuring that contract requirements are being met on all task orders issued under this contract. He will not be involved with the daily project management except when a deficiency is noted by the CEHNC contracting officer or her representative.

2.1.04 Mark G. Bagel, professional geologist (PG), is the EEG project manager. He will be EEG's main point of contact for the client and the field teams and is responsible for overall project operations, scoping, scheduling, and budgeting. He will interface with the independent QC manager to ensure that all QC operations are being met, submit required reports, and resolve all non-conformance issues.

2.1.05 Gary Tourtellotte is the EEG site manager. He will perform daily inspections; ensure proper sample collection, handling, testing, and custody; provide daily reports to the project manager and the analytical coordinator; provide corrective actions for field deficiencies and ensure that they are instituted; complete field change requests; interface with the CEHNC project manager and support team; coordinate and direct the field effort; supervise field teams; coordinate with waste-disposal companies; assist with sample collection; provide daily safety checks; and complete accident and incident reports.

2.1.06 Either the project manager or the site manager will be on site during the sampling effort. When the site manager is not on site, the project manager will be responsible for completing the tasks to be performed by the site manager.

2.1.07 Karen Hatfield is the analytical coordinator. She will be the point of contact for the analytical laboratory and will review field and sample receipt reports and perform data validation.

2.2 Points of Contact

The following table provides point-of-contact information for this project.

Table 2-1. Points of Contact

Name	Position	Phone Number
Brendan Slater	CEHNC Project Manager	(256) 895-1507
Mark G. Bagel, PG	EEG Project Manager	(352) 333-2652
Rebecca Terry	CEHNC Project Chemist	(256) 895-1460
Laura Percifield	Quality Assurance Laboratory	(402) 444-4314
Karen Hatfield	EEG Analytical Coordinator	(352) 333-2681

3.0 Project Scope and Objectives

3.1 Task Description

3.1.01 EEG has been tasked with the sampling of surface soil in the detonation areas to determine the impact of the detonation of explosives on the chemical quality of the soils that exist at the former naval range. EEG will determine the existing conditions of the soils at the former range and the nature of explosive residue and metals after the detonation of MEC items at the range.

3.1.02 EEG will collect pre- and post-detonation composite samples at demolition sites where MEC is destroyed. A pre-detonation location is defined as any location immediately adjacent to where a demolition activity is about to be performed, and a post-detonation location is defined as any location where detonation of ordnance has been conducted within the past two months. The post-detonation sample will be collected only when the use of that demolition site is completed.

3.1.03 A total of 50 composite samples will be collected, which includes 10 percent blind replicates plus matrix spike (MS) and matrix spike duplicate (MSD) samples collected at a rate of 1 per 20 samples. (Greater than 50 or less than 50 samples may be analyzed depending on the number of unexploded items found and the number of remedial detonations required.) MS and MSD samples will be collected from the same container as the original sample and will not require separate sample jars. Equipment blanks will not be submitted, as EEG will use dedicated polypropylene scoops for sample collection and dedicated polypropylene mixing vessels for compositing soil samples.

3.1.04 EEG will use Severn Trent Laboratories (STL) Chicago as the environmental laboratory. STL Chicago has been approved previously for use on the Culebra project and has the proper United States Army Corps of Engineers (USACE) certifications. STL Chicago will supply a Puerto Rico-licensed chemist for sample data certification in accordance with Puerto Rico Environmental Quality Board requirements. Perchlorate samples will be shipped to STL Sacramento for analyses. STL Sacramento also has the proper USACE certifications.

3.1.05 Each pre- and post-detonation composite sample shall be analyzed for TAL metals plus strontium by Methods 6010B/7471A, and for explosives by Method 8330, plus PETN and NG by Method 8332M. Perchlorates will be analyzed using Method 314.0, with a detection limit of 40 parts per billion (ppb).

3.1.06 The sample analyses will include the QC samples as shown in **Table 3-1**.

Table 3-1. Sample Methods, Quantities, and Quality Control Samples

Analytical Group	Method	Depth	No. of Samples	Field Replicates	MS	MSD	Equipment Blanks	Total Samples
Explosives	8330	Surface	40	4	3	3	0	50
PETN, NG	8332M	Surface	40	4	3	3	0	50
Perchlorate	314.0	Surface	40	4	3	3	0	50
TAL metals plus strontium	6010B, 7471A	Surface	40	4	3	3	0	50

3.2 Site Access

United States Corps of Engineers Jacksonville District will provide right of entry for all locations of removal actions.

3.3 Project Schedule

Work is expected to begin by the end of February 2006.

4.0 Non-Measurement Data Acquisition

Non-measurement data acquisition describes those data needed from non-measurement sources. This may include information obtained from databases, literature, handbooks, local planning authorities, and other specific organizations. Information of this type may be needed to support risk assessment (local relevant or significant habitats, endangered species, future land uses, and well surveys), geological data (site bedrock formations, soil series), hydrogeological data (local or regional aquifers), meteorological data, and data supporting modeling activities.

4.1 Current Land Use

4.1.01 Ordnance operating unit (OOU) 3 is located in the east-central part of Culebra Island on the western slope of the hill named Cerro Balcon. The OOU encompasses approximately 30 acres and extends from the southern part of the San Isidro region of the island to the northern part of the Fraile region. The entire unit is privately owned and used primarily for grazing. Part of the unit is fenced. Access by the public is restricted by the landowner, poor roads, thick vegetation, and the fencing. At the time of the Engineering Evaluation / Cost Analysis (EE/CA) Action Memorandum, the future land use was to remain as grazing; however, present plans are for possible residential land development in this area. Houses have begun to be constructed atop the overlooking hills.

4.1.02 OOU-4 includes an 82-acre portion of the 266-acre Isla Culebrita, located east of Culebra Island. The island is currently administered by the United States Fish and Wildlife Service (FWS). Past use was minor recreation, and current use is recreation, including swimming, boating, and hiking. The island is accessible only by boat. Permission from FWS must be obtained before accessing the island. Approximately 21,000 people visit the island in a typical year. Several tour guides are permitted access to the island. The north bay of Isla Culebrita is a popular area for boaters and beach visitors. The island will remain under the administration of FWS and may be further developed with hiking trails.

4.1.03 OOU-5 consists of all the small cays that were identified by the Archives Search Report (ASR) as being part of the Culebra Island naval facility, including Cayo Botella, Cayo Alcarraza, Los Gemelos, Cayo Lobo, Cayo del Agua, Cayo Tiburon, and Cayos Geniqui. All of the islands have rugged terrain and limited beach areas. Most of the small cays are accessible only during calm seas and good weather. All of the cays are administered by FWS and require an entry permit. Access is currently limited to FWS personnel and will be similarly limited in the future.

4.2 Climate

Culebra Island has a tropical marine climate, with a year-round average daily temperature of 80 degrees Fahrenheit (°F). The average rainfall is 36 inches, and the average humidity is approximately 73 percent, with a daytime average of approximately 65 percent and a nighttime average of approximately 80 percent. The most humid months are August through January, although the humidity in the remaining months is only slightly lower. Prevailing winds are from the east-northeast for November through January and from the east for the rest of the year. Average wind speed is 8 knots. The hurricane season is from June through November, with most storms occurring July through September. Severe hurricanes occur through this area every 10 to 20 years.

4.3 Topography

4.3.01 Culebra Island (598 acres) has sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is mountainous, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate. Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate. The surrounding cays exhibit similar topography.

4.3.02 The National Oceanic and Atmospheric Administration estimates that water depths average approximately 70 to 90 feet in the areas surrounding Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local maritime charts show “Caution UXO [unexploded ordnance]” in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

4.4 Geology

4.4.01 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

4.4.02 Culebra and the adjacent cays are underlain by volcanic and intrusive rocks of Upper Cretaceous Age. Andesite lava and andesite tuff are clearly dominant. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995).

4.4.03 The bedrock beneath most of Culebra is andesite lava and lava breccia. This material is generally overlain by a thin (generally 2 to 3 feet thick) layer of disturbed saprolite (USACE-RI 1995). In the area of the project sites, the ground surface has been impacted by the detonation of ordnance as part of Department of Defense (DoD) activities.

4.5 Hydrogeology

4.5.01 About a dozen natural springs and seeps exist on Culebra Island, but they are charged only after particularly wet seasons. Some wells 10 to 20 feet deep exist in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. As a result, most Culebra citizens get their fresh water from the desalinization plant installed by the Navy at the lower camp or from a potable-water pipeline that connects Culebra with the main island of Puerto Rico (USACE-RI 1995).

4.5.02 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as a potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the surrounding cays.

4.5.03 Surface water is also scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and collect and drain runoff water only during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons.

4.6 Soils

Soil is predominately a saprolite (weathered rock), and on average it extends to a maximum depth of approximately 4 feet. Most soils, except along the slopes, are the result of weathering bedrock.

The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate. Igneous rock underlies the saprolite.

4.7 Cultural and Natural Resources

Cultural and natural resources are discussed in the Environmental Protection Plan (Chapter 11 of the Work Plan).

5.0 Field Activities

5.0.01 EEG will explosively destroy all MEC found during the removal action. When MEC is identified, a composite sample will be collected before and after destruction of the item. Each pre- and post-detonation sample will consist of six discrete grab samples (sub-samples) homogenized to form a composite sample.

5.0.02 MEC avoidance will be conducted at all sample locations by an UXO Technician II using a White's metal detector prior to sample collection. Pre-detonation samples will be collected at the closest distance to the item at which an anomaly is not detected. Post-detonation samples will be collected after the scrap is removed to ensure that no magnetic anomalies are in the sample area.

5.1 Field Procedures

5.1.1 Composite Surface Soil Sampling

5.1.1.01 Pre-detonation sub-samples will be collected immediately next to (within 1 foot) the MEC item or at the bottom of a demolition pit excavated specifically for demolition activities. The six sub-sample locations will be equidistant from each other within the 1-foot circumference of the MEC item or within the excavated area. Pre-detonation sub-samples will be collected just below the surface vegetation at a depth of approximately 1 inch to 2 inches.

5.1.1.02 Post-detonation sub-samples will be collected in the bottom of the crater created by the demolition operations. The six sub-sample locations will be equidistant from each other within the crater area. Care will be taken to ensure that metal fragments or sand from sandbags are not included in the sample. Post-detonation sub-samples will be collected from the soil surface to a depth of approximately 1 inch.

5.1.1.03 All vegetation and debris will be removed from the sub-sample location prior to sample collection. Each of the six sub-samples will be collected using a factory-sealed and clean polyethylene scoop dedicated to that one specific composite sample.

5.1.1.04 The sub-samples are placed into a factory-sealed and clean polyethylene mixing tray and divided into quarters. Each quarter is mixed separately, and then all quarters are mixed into the center of the tray. This procedure is repeated several times (a minimum of three repetitions) until the composite sample is adequately mixed and homogenized.

5.1.1.05 As the final step of mixing, the soil sample is arranged in a pile along the long axis of the mixing tray. The polyethylene scoop is moved across the entire width of the short axis of the pile to collect a swath of sample. Multiple evenly spaced swaths are collected until the pre-cleaned glass sample containers are full. Multiple containers are filled by rearranging the remaining material and collecting swaths as described. The glass containers will be carefully labeled and wrapped to prevent glass breakage. Samples containers will be placed in a cooler with bagged ice to keep the temperature of the samples at approximately 4 degrees Celsius (4°C).

5.1.2 Sampling Equipment

5.1.2.01 Required equipment for collection of soil samples includes:

- Nitrile gloves
- Coolers
- Ice
- Ziploc bags
- Pre-cleaned glass jars and lids
- Chain-of-custody forms
- Factory-sealed and clean polyethylene scoop
- Factory-sealed and clean polyethylene mixing tray
- Field notebook
- Sample labels
- Waterproof pen for labeling

5.1.2.02 Sample data, including sample name, location, sample time, sample type, sample description, and other appropriate data, will be recorded on the Surface Soil Sampling Form. A copy of this form is included in Appendix F of the Work Plan.

5.1.3 Sample Containers, Preservation, and Holding Times

5.1.3.01 The soil samples will be held on site for as short a time as reasonable. The samples must be maintained and received by the analytical laboratory at 4±2°C in a timely fashion so that the analysis can be conducted within holding time.

5.1.3.02 **Table 5-1** lists the recommended sample containers, preservation, and holding times for the analytical groups to be collected.

Table 5-1. Recommended Sample Containers, Preservation, and Holding Times

Parameter / Group	Container	Preservation[1]	Maximum Holding Time[2]	Minimum Volume[3]
METALS				
TAL metals plus strontium by 6010B/7471A	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
ORGANICS				
Explosives by 8330 (HPLC)	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
NG/PETN by 8332M (HPLC)	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
INORGANICS				
Perchlorate by 314.0	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces

Notes:

1 = Sample preservation should be performed immediately upon collection. Samples may then be preserved by maintaining at 4°C.

2 = Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

3 = Three times enough sample will be collected for MS/MSDs.

HPLC = High-performance liquid chromatography

5.2 Field Quality Control and Quality Assurance Samples

5.2.1 Equipment Blanks

Equipment blanks will not be collected, as the equipment will be pre-cleaned, pre-packaged, and dedicated to each individual sample site.

5.2.2 Quality Control Samples (Field Replicate Samples)

Field replicate samples will be collected at a rate of 10 percent of the total samples. Each pre- or post-detonation sample designated for a field replicate must be homogenized thoroughly and divided equally. The field replicates will be given false sample identification (ID) that will identify them as field replicate samples. The fact that a sample is a field replicate will be noted only on the Surface Soil Sampling Form and in the field notes.

5.2.3 Quality Assurance Samples

5.2.3.01 Quality assurance (QA) samples will be collected from 10 percent of the total quantity of samples. The QA samples will be collected from the location that is chosen for the field replicate sample, and the quantity of material collected shall be sufficient for three samples.

The first two portions shall be submitted to STL Chicago as the primary sample and the field replicate sample. The third portion shall be submitted to the QA laboratory as a split sample for analysis. QA samples shall be shipped by overnight delivery to the government laboratory at the following address:

United States Army Corps of Engineers
Environmental Chemistry Branch (ECB) Laboratory
Attn: Laura Percifield
420 South 18th St.
Omaha, NE 68102
Telephone (402) 444-4314

5.2.3.02 The QA samples shall be analyzed by the same methods used for the primary samples and shall be used to compare the primary and QA data. Sampling containers will be provided by STL Chicago for the QA samples. All QA sample handling and custody requirements will be similar to those that apply to the primary samples. EEG will provide the QA laboratory a minimum of two weeks notice that samples will be shipped.

5.2.3.03 The project ID Laboratory Information Management System (LIMS) number will be written onto the labels and chain-of-custody records for all QA samples shipped to the ECB Laboratory. The CEHNC project chemist will be contacted to acquire the LIMS number prior to sample collection. EEG will also obtain a copy of their United States Department of Agriculture soil permit, which must accompany the shipment of soil samples from overseas.

5.2.4 Matrix Spike and Matrix Spike Duplicate Samples

MS and MSD samples will be collected at a rate of 1 per 20 samples in accordance with the Quality Assurance Project Plan (QAPP) (Part II of this Sampling and Analysis Plan). The samples will be collected from the same sample locations from which the primary samples are collected but identified as described in Chapter 6.1.1 of this FSP.

5.2.5 Temperature Blanks

A 4-ounce or greater plastic container will be filled with tap water and shipped with each cooler to be a temperature blank. The temperature will be measured upon receipt of the sample from the laboratory and recorded on the chain-of-custody form and on the laboratory’s sample receipt form. A copy of the chain-of-custody form is included in Attachment E of the QAPP.

5.3 Surveying

The EEG field team will survey the locations of the soil samples using a Trimble XRS global positioning system (GPS) corrected to the Coast Guard beacon to determine the coordinates of sampling points to within 1-meter accuracy. Coordinates will be in the Universal Transverse Mercator (UTM) Zone 20 North projection using the North American Datum of 1983 (NAD83).

6.0 Field Operations Documentation

This chapter provides a description of the procedures required for proper documentation of tasks during field operations.

6.1 Sample Identification

Samples collected during the field effort will be fully documented from their collection to their arrival in the laboratory. This documentation will be done in indelible ink. Samples will be uniquely numbered and identified on appropriate data log sheets, sample containers, and chain-of-custody forms. Upon arrival at the laboratory, the sample chain-of-custody form will be checked against the sample containers received.

6.1.1 Sample-Numbering System

6.1.1.01 A sample-numbering system will be used to identify each sample collected in the field by matrix and location. **Table 6-1** provides the nomenclature for identifying the sample location type and matrix.

Table 6-1. Sample Code Prefix

Code	Description
SS-###-PRE SS-###-POST	Pre- and post-detonation samples and field replicate sample; replicated – use a false sample ID number
SS-###-MS	Matrix spike
SS-###-MSD	Matrix spike duplicate
Key: SS = Surface soil ### = Sample location (e.g., 002) Replicate samples will be given a false sample ID.	

6.1.1.02 The sample prefix will be followed by the sample location number. For example, a pre-detonation soil sample collected from surface soil location number 7 will be labeled SS-007. The field duplicate ID will include a false soil sample location number. A false sample time will be used to further hide the source of the sample. This false data will be noted on all documentation to the laboratory, but will be identified in the field logs. The blind replicate ID will be annotated in the field logbook and the daily field reports only. MS and MSD samples obtained from the same sample jar as the original sample. The sample jar will include all three designations as the sample ID (i.e., SS-001-PRE, SS-001-MS, and SS-001-MSD).

6.1.2 Sample Data Forms

Sample data forms will be secured in a bound field data logbook as described in Subchapter 6.2.1.2 of this FSP. Sample data forms include the Surface Soil Sampling Form and the Chemical Quality Control Report. Copies of the data forms are included in Appendix F of the Work Plan.

6.2 Documentation

6.2.01 All aspects of the field effort will be documented to provide a traceable record of activities, including meetings, sample collection, installation, and other project-specific activities. The field notes must contain enough detail such that, at a later date, an individual (not part of the field team) could reproduce the entire field effort by reading through the field notes. All signatures and initials must be legible.

6.2.02 The documentation required by this project includes:

- Field logbooks
- Photographs
- Chemical Quality Control Reports

6.2.03 All field notes will be written in the logbook by the site manager either during or immediately following completion of an activity. Since different tasks may have different team leaders, the author will refer to himself by name or initials, but never in the first person.

6.2.04 Maps drawn in the field must be to scale or have dimensions or distances placed on the items. A north arrow must be placed on all maps and appropriate drawings, and locations on the maps should be relative to an identifiable fixed object in the field.

6.2.05 The cover of a field logbook must contain the following information:

- Project name
- Project number
- Summary of the tasks in the book (i.e., soil sampling)
- Sequential book number
- Start date
- End date

6.2.06 All time observations should be recorded using military time. The time that an activity occurs (e.g., sampling, equipment start, conversations, etc.) will be recorded in the field logbook.

6.2.1 Field Logbooks

Two types of field logbooks will be kept during this project: daily time logbooks and field data logbooks. Each sampling team will complete daily time logs and field data logs as each task is conducted.

6.2.1.1 Daily Time Logbooks

6.2.1.1.01 Daily time logs will be kept in a hardcover professionally bound surveyor's field book, record book, or composition notebook. The daily time log will be used to record activities or items such as meeting minutes, telephone conversations, weather changes, general site activities, site observations, QC notes, safety observations, conversations, and field orders and directions. Arrival times of any visitors, whether the visit is project- or non-project-related, must also be identified in the daily time logs. Each daily time log will have the day and date clearly marked at the top of the page, followed by ID of the field team. The records will follow chronologically with the time and description of the activity or item. The pages of the daily time logs must be consecutively numbered and bound so that they cannot be removed without damaging the notebook.

6.2.1.1.02 Field sampling team ID will include each team member's full name, initials, and responsibilities. References to the field team using first person (I, we) or third person (he, she, they) is not acceptable. All references to the field team members or on-site contacts must be recorded using full names or initials. Throughout the field notes, initials of people on site must be consistent with those previously recorded in the daily time log.

6.2.1.1.03 At the end of each day, EEG's site manager will sign and date the daily time log, and any empty space remaining on the page will be marked to prevent additional notes being recorded that day. If the site manager's signature is not legible, it must be accompanied by his printed name. The following day's time log will start on a new page.

6.2.1.2 Field Data Logbooks

6.2.1.2.01 Field data logbooks are bound compilations of field data sheets used to record field sampling data. Each field sampling activity will have its own formatted data sheet for the completion of that activity. All blanks on each data sheet must be completely filled out as appropriate.

6.2.1.2.02 Field data logbooks must be bound in a manner that will prevent them from coming apart in the field. The use of loose pages clamped together in a clipboard or bound with staples is not acceptable. Comb binding will be used to secure field data sheets on this project.

6.2.2 Chemical Quality Control Reports

A Chemical Quality Control Report form will be used to document each day's sampling activities. The report will include the personnel and equipment, safety inspections and activities, summary of the daily field sampling activities, summary of samples collected, summary of field discussions with client, visitor list, and other pertinent data.

6.2.3 Corrections to Documentation

Field documents should be written with indelible waterproof black ink. No erasures are permitted. If an incorrect entry is made, the data should be crossed out with a single strike mark, initialed, and dated, and the correct data entered. An effort must be made to make all field documents legible and concise.

7.0 Sample Packaging and Shipping Requirements

7.1 Sample Chain-of-Custody Form

7.1.01 A completed chain-of-custody form will accompany all the samples shipped to the laboratory for chemical analyses. The chain-of-custody form for the samples will be sealed in a Ziploc bag and taped to the inside of the shipping container. The shipping container is also sealed with two signed and dated custody seals.

7.1.02 The primary objective of sample chain of custody is to provide an accurately written, verifiable record that allows tracing of the samples from the moment they are collected to their receipt by the laboratory. The chain-of-custody form will contain:

- Project data, including project name and job number
- Sample information, including sample date, time, location, and the parameter analysis groups
- Sample custody log, including names of persons relinquishing and receiving the samples and the dates and times of their transfers

7.2 Sample Labels and Tags

Each individual sample will be identified with an ID label or tag that will be affixed to the sample container in a manner that will prevent it from coming off when the sample container is cold or wet. The information recorded on the label will include:

- Sample ID number
- Source or location of sample
- Date sample was obtained
- Time sample was collected
- Sampler's initials

7.3 Sample Packing

The following procedure is used for packing samples for shipping.

- Drain plug on cooler will be taped shut inside and out.
- Large plastic bag is placed in cooler as liner.
- Individual sample container is wrapped in bubble wrap.
- Bubble-wrapped sample container is placed in small plastic bag.
- Bagged sample containers are placed upright in cooler.

- Bubble wrap or other packing material is placed between individual sample containers in cooler.
- Cooler is filled with enough ice to keep the temperature at 4°C ± 2°C during shipping and until arrival at laboratory; enough packing material will used so that individual sample jars are not insulated from the ice. (Note: Care must be taken to make sure jars are not touching each other to prevent breakage during shipment.)
- Cooler is closed and sealed with filament-style strapping tape or equivalent.
- At least two custody seals are placed across the hinge line (one on the front and one on the side of the cooler) in a manner that will indicate whether tampering of the cooler has taken place.
- Posted on all four sides of the cooler are “This Side Up” labels, and posted on two sides and on the top are “Fragile” labels.

7.4 Sample Shipment

The custody of the sample coolers will be relinquished to the STL service center in Puerto Rico, or directly to Federal Express for shipment to STL Chicago. A copy of the laboratory’s United States Department of Agriculture permit is required to be placed with the shipping documents and manifest for shipments of soil samples from Puerto Rico.

8.0 Investigation-Derived Waste

The only sampling-related investigation-derived waste (IDW) will be the scoops and sample-compositing trays. Excess soil will be removed from the scoops and trays before placing them in a plastic bag. The bag with the scoops and trays will be disposed of at the local landfill.

9.0 Field Assessment – Three-Phase Inspection Procedures

9.0.01 To ensure that quality is maintained throughout all phases of this sampling effort, a three-phase control process (Engineer Regulation [ER] 1180-1-6, Contracts Construction Quality Management; and USACE Unified Facilities Guide Specifications 01450A, Chemical Data Quality Control, and 01451A, Contractor Quality Control) is followed. Preparatory, initial, and follow-up QC phases are performed on site by an assigned EEG QC officer whether or not a government representative is present. The QC officer will summarize the activities of each QC phase in the Chemical Quality Control Report. Because of the small amount of sampling required for this project, the EEG-site manager will be responsible for sampling QC.

9.0.02 Subchapter 5.1, Field Procedures, describes the activities and lists the field equipment and supplies required during these phases.

9.1 Preparatory Phase

9.1.01 The EEG site manager, in conjunction with the sampling team, will conduct the preparatory phase meeting prior to sampling at the site. This includes a review of all work requirements, a discussion of all required material and equipment, an examination of sample location areas, and a discussion of all field activities. If new sampling personnel arrive on site during the work effort, the site manager will repeat the preparatory phase with these personnel prior to beginning work. All personnel will review in detail this FSP, prior to this meeting, and will participate in a discussion of all pertinent sections of this plan during the preparatory meeting.

9.1.02 It will be verified during the preparatory phase meeting that the following required items are on site:

- FSP
- Area maps
- Field logbooks and indelible ink pens
- Recommended Sample Containers, Preservation, and Holding Times (**Table 5-1**)
- Chemical Quality Control Report forms
- Chain-of-custody forms (see Attachment E of QAPP)
- Sample shipping documents
- Sampling equipment (listed in Subchapter 5.12)
- Personal protective equipment (PPE)

- Sample containers and labels
- Sample preservatives (i.e., ice)
- Sample coolers and sample packing materials
- IDW storage containers (e.g., plastic trash bags)

9.1.03 The sampling team will also demonstrate how each composite sample will be collected using the intended sampling equipment and following the sample-compositing procedures. The sample-numbering system, sample labeling, laboratory turnaround times, laboratory tracking system, and sample shipment documentation requirements will also be discussed.

9.2 Initial Phase

The initial phase inspection will be performed by the EEG site manager, who will oversee sampling activities and review the work for compliance with contract requirements. At minimum, this will include the following:

- Inspection of field notes to ensure that all pertinent data are recorded according to project requirements
- Inspection of individual sample labels and chain-of-custody forms for accuracy, completeness, and consistency
- Inspection of the packaging of the samples
- Ensuring that primary and QA samples are correctly matched and recorded in the field logbook and Chemical Quality Control Reports.

9.3 Follow-Up Phase

Follow-up phase inspections will be performed on an as-needed basis by the site manager to ensure continued compliance with project requirements until completion of that particular feature of work. General procedures and documentation will be periodically checked to ensure that they are complete, accurate, and consistently executed throughout the duration of the project. Inspections will also include a review of any field data. Soil sampling will be closely monitored to make sure that the samples are properly collected, composited, stored, packaged, and shipped.

10.0 Corrective Actions

10.1 Recognition of Problems

10.1.01 Problems requiring corrective actions may occur in the field, during sample shipment, or at the laboratory site. To ensure field data quality, the EEG site manager will audit daily sampling procedures as they are being performed at the job site. Sampling procedures that are observed will be reported in the Chemical Quality Control Report. Once samples are collected and shipped, the site manager will notify the EEG analytical coordinator with shipment tracking numbers, sample IDs, and other appropriate data.

10.1.02 The EEG analytical coordinator will track the shipment of samples and laboratory non-conformance memoranda. She will receive sample arrival notifications, sample quality reports, notification of holding time exceedances, and notifications of problems that may affect sample quality from the laboratory project manager. She will notify the EEG project manager of all non-conformance issues with regard to the laboratory. The EEG project manager will contact the CEHNC project manager to discuss the non-conformance issue.

10.2 Implementation of Corrective Actions

10.2.01 To the extent possible, EEG or its subcontracting laboratories will resolve all situations that require corrective action before data quality is compromised. Such corrective action does not require documentation in a formal non-conformance memorandum but may be addressed in the Chemical Quality Control Report.

10.2.02 Corrective actions that involve compromised field data will be implemented after a thorough review of the non-conformance by the EEG project manager, the EEG analytical coordinator, the EEG site manager, and the CEHNC safety specialist. The results of the review will be compiled and the corrective action will be noted on a Non-Conformance Report. Corrective actions will be performed by the appropriate field or laboratory personnel in accordance with the Non-Conformance Report.

10.3 Documentation and Verification

The EEG site manager or project manager will be responsible for ensuring that field procedures are followed properly. Any non-conformance issues that are not immediately corrected will be reported to the CEHNC safety specialist. These notifications will be presented on a Non-Conformance Report included with the Chemical Quality Control Report. The Non-Conformance

Report will be used to track a non-conformance issue through the corrective action stage and into the verification stage. A copy of a blank Non-Conformance Report is included with the field forms in Appendix F of the Work Plan. After completion of the non-conformance reporting process, the Non-Conformance Report, including the approval history, will be supplied to the CEHNC safety specialist.

10.4 Responsibilities

The EEG analytical coordinator will report all laboratory non-conformances to the CEHNC safety specialist. The notifications will be provided on a Non-Conformance Report and provided on an as-needed basis.

11.0 References

11.0.01 United States Army Corps of Engineers, Rock Island District (USACE-RI), 1995. Archives Search Report Findings for Culebra Island National Wildlife Refuge, Culebra Island, Puerto Rico, Project Number I02PR006802.

11.0.02 United States Geological Survey (USGS), 1999. Groundwater Atlas of the United States Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; HA 730-N; Puerto Rico and the U.S. Virgin Islands Regional Summary. At URL: http://capp.water.usgs.gov/gwa/ch_n/N-PR_Vitext1.html.

11.1 Additional Sources

11.1.01 ASTM D6051-96 (Reapproved 2001). Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities.

11.1.02 Ellis Environmental Group, LC, 2001. *Final Work Plan, Construction Support, Culebra National Wildlife Refuge, Puerto Rico.* U.S. Army Corps of Engineers, Huntsville Center, Contract No. DACA 87-00-C-0001 (revised September 2001).

11.1.03 Federal Environmental Management Agency (FEMA), 2000. Project Impact Community (Culebra Island) Conducts Risk Assessment and Vulnerability. At URL: http://www.fema.gov/nwz00/culebra.htm (with maps and tables).

11.1.04 MTA, Inc., 1995. *Final Removal Reports. Interim Remedial Action, Culebra Island NWR, P.R. Remediation of Sites in the U.S. Virgin Islands and Puerto Rico.* Contract No. DACA 87-92-92-D-0147, Delivery Order 0002, Prepared by MTA, Inc., Huntsville, Alabama, November 15, 1995.

11.1.05 United States Army Corps of Engineers, Washington D.C., Engineering and Design – Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 01 February 2001.

11.1.06 United States Environmental Protection Agency, 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.*